CHAPTER 21

BRIDGE BEARINGS

21.1 Bearing Selection Evaluation

The design requirements for bearings are the same for either steel or concrete beams. For anchor bolt design, refer to Section 10.29.6, Anchor Bolts, in the **AASHTO Standard Specifications for Highway Bridges**. Anchor bolts must meet the seismic requirements.

- The bearing type selection must be based on achieving the most economical solution that will support all required movements. An initial evaluation will reveal that elastomeric bearings or elastomeric bearing pads will often be the lowest maintenance and most economic solution as a bearing selection.
- Economics must not be the sole category in selecting bearing types. Accommodating longitudinal, transverse and rotational movements as well as consideration of governing skew controls should be evaluated in the bearing selection.

NOTE: The District also has standard bearings.

The following guidance is to be considered for the design of new structures or for those projects that involve, as applicable, a superstructure replacement.

Bearing devices are designed to transmit the loads from the superstructure to the substructure and to provide for expansion, contraction, and rotation of the superstructure. The devices must be able to withstand forces from several directions simultaneously. The bearings must also accommodate movements of the structure that result from loads, temperature change, deflection, impact and centrifugal force. The design should be such that the bearings are easy to maintain and require a minimum of maintenance. Consideration should also be given to the future need to jack girders to permit repair, lubrication, and maintenance of bearing devices.

The designer will be concerned with two types of bearings: fixed and expansion. Some bearing materials can be used for either fixed or expansion bearings. The amount of movement that each type of bearing can provide must be considered in selecting the bearing type. The types of bearings include:

21.1.1 Reinforced Elastomeric Bearings

A combination of materials that may include reinforced fiber mesh, steel and neoprene - These bearings require the least maintenance but are susceptible to deterioration from ozone and ultraviolet light. Reinforced elastomeric bearings are suitable for movements up to 2 1/2 in. Reinforced elastomeric bearings should be considered over other types of bearings in the majority of cases. Refer to Section 14, Elastomeric Bearings, in the **AASHTO Standard Specifications for Highway Bridges** for design procedures.

21.1.2 Neoprene Bearings

Un-reinforced single material bearing pads - They are used at fixed ends of voided slab and concrete box girder structures. The designer should size neoprene bearings in accordance with the manufacturer's allowable bearing stress.

21.1.3 Steel Sliding Plate for Expansion Bearings

May be a combination of steel plate, polished stainless steel sheet, polytetraflouroethelyene (TFE), and urethane - Steel sliding plate bearings are suitable for movements up to 2 in. These bearings are less vulnerable to environmental deterioration than elastomeric bearings. Longitudinal movement is accommodated by either two polished surfaces sliding on each other or the stainless steel sliding on the TFE surface. Rotation is provided by the curved surfaces sliding on each other or by deformation of the urethane pad on TFE bearings. Refer to Section 15 in the **AASHTO Standard Specifications for Highway Bridges** for design of TFE bearings.

21.1.4 Steel Plate for Fixed Bearings

Anchor the span and provide for rotation of the fixed end of the beam. Rotation is provided by the curved surfaces sliding on each other. The height of the fixed bearing assembly can be designed to accommodate various bearing seat and beam requirements.

21.1.5 Rotational Bearings

Made with matching machined steel concave and convex surfaces - Rotational bearings may be either fixed or expansion. Rotation is accommodated at the matched concave and convex surfaces. Longitudinal movement for the expansion bearing is provided by sliding of the concave plate against the sole plate of the beam. Rotational bearings require a minimum of maintenance. Rotational expansion bearings are suitable for movements up to 2 ½ in.

21.1.6 Pot Bearings

High-load multi-rotational bearings - The basic rotational bearing can be combined with a TFE and stainless steel sheet to allow translation. The direction of translation can be controlled using guide bars. Pot bearings consist of a piston and pot arrangement similar to a hydraulic cylinder in which elastomer is used to accommodate the rotational deformation. Inherent problems with this type of bearing include leakage of the elastomer and failure of the seal rings.

NOTE: For pot or rotational bearing design, refer to **FHWA Region 3 SCEF Specification SBS 1010-93, Structural Bearing Specifications**.

21.2 Rocker Bearings

- Rocker bearings are mechanical-type bearings.
- Rocker bearings are used only when no other bearing type will provide for the required movement of the structure.
- Rocker bearings are not used by the Department because of the increased seismic vulnerability and high maintenance requirements.
- Rocker bearings can accommodate translation and rotation in only one direction.

NOTE: Refer to **Section 10.29, Fixed and Expansion Bearings**, in the **AASHTO Standard Specifications for Highway Bridges** for design requirements.

21.3 Seismic Provisions

The United States is divided into four Seismic Performance Categories (SPC) (A through D) based on the acceleration coefficient and the importance category. Areas in SPC "A" are the least likely to experience earthquakes. Refer to Division I-A, Seismic Design, in the **AASHTO Standard Specifications for Highway Bridges.** Seismic provisions apply to the connections between the superstructure and substructure. District is in Seismic Performance Category (SPC) "A".

The design requirements for SPC "A" apply to the bearing area dimensions and the superstructure/substructure connection. This connection must be designed to resist horizontal seismic forces equal to 0.20 times the dead load reaction force applied in the restrained directions.